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Contrast Effects in Investment and Financing Decisions

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Abstract

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Keywords

Risk Attitude, Corporate Finance, Behavioral Finance, Investment

Disciplines

Behavioral Economics | Economic Theory | Finance

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Abstract

Contrast effects, a bias caused by a prior stimulus, has not been extensively studied in a financial context. This study develops an experimental design to examine whether contrast effects distort the risk attitudes of individuals under a choice-based elicitation procedure. We find that individuals exposed to a positive stimulus amplify risk-seeking in investment decisions as opposed to individuals exposed to a negative stimulus. However, individuals behave similarly in making financing decisions regardless of different economic stimuli, which could suggest that financing decisions require a high cognitive load. On average, individuals spent 4% more time and changed their answers 4% more often in making financing decisions than investment decisions. The results suggest financing decisions may require a higher mental effort, and provide robust evidence that contrast effects can lead to mistakes in investment decisions.

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JEL: D81, G02, G11, G30

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The effect of the behavior of individuals in financial markets is a rising concern in financial economics. In real-world situations, investors and managers are seldom replaced by programmed rational agents as assumed in the traditional models. The behavior of individuals is critical to address empirical puzzles in financial economics. This study uses the fourfold pattern of risk attitudes to examine the behavior of individuals.

The fourfold pattern of risk attitudes summarizes cumulative prospect theory (Tversky and Kahneman, 1992): risk seeking for gains of low probabilities, risk aversion for gains of high probabilities, risk aversion for losses of low probabilities, and risk seeking for losses of high probabilities. Tversky and Kahneman (1992) deviate from prospect theory and further develop cumulative prospect theory to support first-order stochastic dominance. Cumulative prospect theory posits that individuals overweight low-probability events and underweight high-probability events (Tversky and Kahneman, 1992). For instance, Kahneman (2011) shows individuals perceive an increase from 0% to 5% as more impressive than an increase from 5% to 10%. Although both intervals are quantitatively equal, the change from 0% to 5% is also a qualitative change, which is more impressive because it provides a possibility where none existed before. This possibility effect can explain why people put more weights in low-probability outcomes and buy lottery tickets. Another assumption for cumulative prospect theory is that individuals are risk-seeking for losses and risk-averse for gains. These assumptions lead to the fourfold pattern of risk attitudes.

This paper attempts to fill gaps in the literature of behavioral finance by addressing how contrast effects have an impact on investment and financing decisions, and how these results account for stock market crashes, frenzies, and security issuance decisions. Little is known of contrast effects in a financial context. Hartzmark and Shue (2016) attempt to provide evidence of

how contrast effects distort prices in financial markets. They find that investors “mistakenly perceive earnings news today as more impressive if yesterday’s earnings surprise was bad and less impressive if yesterday’s surprise was bad” (Hartzmark and Shue, 2016). It is evident that a prior stimulus affects the behavior of individuals.

Inspired by the work of Hartzmark and Shue (2016), the experiment introduced in this paper uses a prior stimulus as a treatment. The experimental design is based on the experiment using a choice-based elicitation procedure by Harbaugh et al. (2009). However, it is different in three ways: (i) this experiment takes place in a financial context by asking participants to choose between a stock and a bond, (ii) individuals are faced with investment and financing decisions, and (iii) some participants are exposed to a prior stimulus related to economic situations.

Several empirical puzzles can be addressed using the experimental results. First, some studies offer evidence that an increase in a firm's stock price leads to issuing more equity (Stein, 1996). Rational managers believe the firms are overvalued at its peak, so they try to take advantage of the high valuation by issuing more equity than bonds. According to the efficient market hypothesis, stock returns cannot be predicted. However, the correlation between issuing equity and stock returns is consistently negative and predictable empirically (Baker and Wurgler, 2000). Second, stock market prices can be overvalued, which can crash the stock market. Previous studies focus on the heterogeneity of agents. John List (2004) provides robust evidence that inexperienced traders are the cause of the distortion in prices because they tend to follow prospect theory rather than neoclassical theory.

We find that individuals exposed to a positive prior stimulus amplify risk-seeking in investment decisions. In other words, individuals exposed to an economic boom stimulus in the experiment are more likely to invest in equity than individuals exposed to an economic

depression stimulus in the experiment. These results provide robust evidence that contrast effects can distort the behavior of individuals, which leads to inefficient stock markets. However, it is not evident that contrast effects influence financing decisions. It could be explained by a deliberative thinking, which leads to a high cognitive load, required for an unfamiliar task.

The rest of this paper is organized in the following manner: in Section 1, we review the literature that is relevant to this study; in Section 2, we discuss models; in Section 3, we present the experimental design; in Section 4, we discuss results; and Section 5 concludes.

1 Background

Psychology studies show that some components help agents to form expectations. Anchoring is one of them. Individuals anchor on prior values when they make decisions. For instance, Kahneman and Tversky (1974) use a lab experiment to show an initial random number can influence estimating the percentage of African countries in the United Nations. Such anchoring studies are related to contrast effects.

Simonson and Tversky (1992) introduce two types of contrast effects. First, the local contrast effect is a bias to measure how the addition of an element, z , in a set $\{x, y\}$, changes the attractiveness of y in contrast to x . For instance, y is preferred to z , but x is not clearly preferred to z . Then, adding z to the offered set increases the attractiveness of y in contrast to x . Second, the background contrast effect is a bias to measure how past experience influences the attractiveness of y in comparison to x . This paper uses the background contrast effect to explain the distortion of investment and financing decisions following different economic stimuli that are no longer relevant to current decisions.

The background contrast effect is closely related to this study and influences current decisions. It is a bias caused by past experience which is no longer relevant. Simonsohn and

Loewenstein (2006) provide a field experiment based on the work of Simonson and Tversky (1992). In this field experiment, movers from expensive cities rent a higher price of apartments than movers from cheaper cities. Although previously observed prices are not relevant, movers from expensive cities feel that the current prices are cheaper taking account of wealth and taste. In this paper, signals of an economic condition such as pictures and articles are used as treatments. Such signals can be interpreted as narratives. Shiller (2017) defines narratives as explanations of events that can stimulate the emotions of individuals. If people experience strong emotions, these emotions can influence unrelated happenings (Slovic et al., 2007). This paper ultimately shows that changes in the emotions of individuals influence decision making.

2 Model

2.1 Cumulative Prospect Theory

Kahneman and Tversky (1992) provide a way to assign the value of the gamble using cumulative prospect theory in Equation 1. x_i is an outcome, which happens with p_i probability. P_i represents the probability that an outcome takes a value greater than or equal to x_i , and P_i^* represents the probability that an outcome takes a value greater than x_i .

$$\sum \pi_i(p_i)v(x_i) \quad (1)$$

where

$$v(x_i) = \begin{cases} x_i^\alpha & \text{if } x_i \geq 0 \\ -\lambda(-x_i)^\alpha & \text{if } x_i \leq 0 \end{cases} \quad (2)$$

$$\pi_i = w(P_i) - w(P_i^*) \quad (3)$$

$$w(P_i) = P_i^\gamma / [P_i^\gamma + (1 - P_i)^\gamma]^{(1/\gamma)} \quad (4)$$

Previous experimental results provide the estimates of α , γ , and λ as 0.88, 0.65, and 2.25, respectively (Tversky and Kahneman, 1992). According to these experimental estimates, the relative sensitivity of losses is greater than that of gains. Also, the weighting function is an inverse-S-shaped curve as shown in Figure 1. It shows that individuals overweight a small probability and underweight a large probability. The empirical studies show that the absolute difference between the weight and the probability is largest when the probability is 0.1 and 0.8. The difference is smallest when the probability is 0.4 (see Fig. 1). Using the empirical estimates, Harbaugh et al. (2009) propose an experiment to test the fourfold pattern of risk attitudes.

2.2 The Fourfold Pattern of Risk Attitudes

This paper relies heavily on the experimental design using a choice-based elicitation procedure developed by Harbaugh et al. (2009). In their experiment, participants make six choices between a lottery and the expected value of the lottery as shown in Table 1. According to the fourfold pattern of risk attitudes, participants should be risk-seeking by choosing lotteries over expected values for prospects 1 and 6 in Table 1. On the other hand, participants should be risk-averse by choosing expected values over lotteries for prospects 3 and 4 in Table 1.

Hartzmark and Shue (2016) find that individuals perceive earnings news to be less or more impressive if the earnings surprises from the previous day were good or bad, respectively. These results show that a prior stimulus matters in the behavior of individuals. Inspired by their work, this study applies contrast effects into the experimental design developed by Harbaugh et al. (2009) to find whether contrast effects distort investment and financing decisions. For instance, some individuals are exposed to prior economic situations. According to contrast effects, news about an economic boom from one day will lead to earnings the next day looking

less impressive. This makes earnings less of an incentive, and individuals become more risk-seeking (Holt and Laury, 2002). Analogously, news about economic depression from one day will make individuals more risk-averse the next. Simply put, it is anticipated that individuals exposed to a positive prior stimulus amplify risk-seeking over investment and financing decisions as shown in Table 2.

3 Experimental Design

This experiment tests how choices of individuals between a stock and a bond vary with the following treatments: an exposure to a picture related to an economic boom or depression, or an exposure to an article related to an economic boom or depression. It is designed to examine how each treatment affects choices of individuals between a stock and a bond. This paper closely relies on the experiment developed by Harbaugh et al. (2009).

In this experiment, we asked subjects to make three investment decisions and three finance decisions as if they were a manager of a firm. We randomly selected half of the participants to answer three investment questions first, and the other half answered three finance questions first. In each investment question, participants were given a choice to invest in either a bond or a stock. If they invested in the bond, future earnings would result in a certain return, which can be interpreted as a coupon payment in the real world. However, investing in the stock provided a risky return, which can be interpreted as a dividend payment in the real world. The risky return is either a higher return than the bond or no return at all. The following is an example of a part of an investment question:

“Now, you are given a choice to invest in either a bond (certain return) or a stock (risky return). If you choose to invest in the bond, your future earnings will be A\$50. If you

choose to invest in the stock, your future earnings will be either £500 with 1/10 chance or £0 with 9/10 chance.”

On the other hand, in each finance question, participants were given a choice to borrow money through issuing a bond or issuing a stock. If they borrowed money through issuing the bond, they paid a certain cost, which can be interpreted as a coupon payment to bond investors. Borrowing money through issuing a stock results in an uncertain cost. The uncertain cost is either a higher cost than the coupon payment to bond investors or no cost. An example of a part of a finance question is displayed below:

“Now, you are given a choice to borrow money by either issuing a bond (certain cost) or issuing a stock (uncertain cost). If you choose to borrow money by issuing the bond, your future earnings will be -£50. If you choose to borrow money by issuing the stock, your future earnings will be either -£500 with 1/10 chance or £0 with 9/10 chance.”

There were 7 groups, and each group consisted of approximately 64 individuals. A total of 447 individuals in total were included in this study. Group A participated in tasks of choosing between a stock and a bond. Group B participated in tasks of choosing between a stock and a bond with an exposure to a picture related to an economic boom. Group C participated in tasks of choosing between a stock and a bond with an exposure to a picture related to an economic depression. Group D participated in tasks of choosing between a stock and a bond with an exposure to an article related to an economic boom. Group E participated in tasks of choosing between a stock and a bond with both an article and a picture related to an economic boom. Group F participated in tasks of choosing between a stock and a bond with an exposure to an article related to an economic depression. Group G participated in tasks of choosing between a

stock and a bond with both an article and a picture related to economic depression. Table 3 illustrates the setup.

The analysis is based on data using Amazon's Mechanical Turk (M-Turk) subjects. They are individuals paid to perform small tasks over the Internet. In this experiment, a survey dollar, $\$$, was used. $\$1000$ is equivalent to \$1. Participants could have earned a maximum of \$1.5 depending on one of the six choices they made. Individuals earned a minimum of \$0.5. The final expected amount of compensation was \$1. Table 4 summarizes the six choices that a participant faced in the experiment. For instance, individuals need to choose between a stock that can provide a 10% chance of receiving a \$0.5 dividend and a bond that yields a \$0.05 coupon payment. Table 5 summarizes the demographic information of M-Turk subjects. The mean demographic information of individuals in each group is about the same across groups. It shows that participants are randomly assigned to groups, and demographic characteristics cannot account for the results. On average, participants have a high school degree but not a bachelor's degree, and there are slightly more male participants. We performed logistic regression analyses for each group and found that the effect of demographic characteristics was not significant to our results.

This experiment is designed to compare the choices of participants exposed to economic boom conditions with the choices of participants exposed to economic depression conditions. Using the data collected from each group, we can find in what way each treatment affects how individuals choose between a stock and a bond.

4 Results

Table 6 compares the results by groups. We find that individuals are more likely to choose stocks for financing decisions than for investment decisions. In other words, people are more risk-seeking in financing decisions, which is consistent with cumulative prospect theory. Within investment decisions, a difference did exist based on stimuli. Individuals exposed to a picture of an economic boom are more likely to choose stocks, particularly low-probability stocks, than those exposed to a picture of an economic depression. However, the results of 22 percent and 14 percent, respectively, are statistically indistinguishable by the test of proportion (p-value: 0.29). As opposed to pictures, individuals exposed to an article behave similarly regardless of the economic condition described in the article. Individuals exposed to both pictures and articles of an economic boom are more likely to choose mid- and low-probability stocks. The results of 35 percent and 8 percent are statistically distinguishable according to the test of proportion (p-value: 0.00).

The results show that participants, whether statistically significant or not, are more likely to choose to invest in stocks following an economic boom. It implies that people are more risk-seeking in investment when a positive prior stimulus is applied. This leads to mistakes in investment decisions and raises prices of stocks above their fundamental values. These results directly address how contrast effects can explain stock market crashes and frenzies.

In the case of financing decisions, participants behave the same regardless of the economic condition they were exposed to. Possible explanations are described in Section 5.

5 Discussion and Conclusion

This study shows experimental evidence that a prior stimulus can influence the behavior of individuals in a financial context. As shown in Table 6, the distortion in the behavior of people

affects investment decisions.

On the other hand, this study raises a question as to why contrast effects do not lead to mistakes in financing decisions. One possible explanation would be a difference in cognitive load between investment decisions and financing decisions. For instance, people may use different amounts of mental effort when they make different types of decisions. Table 7 shows the number of click counts that subjects made for investment and financing decisions. We can assume click counts is the number of time that subjects changed their answers. Subjects changed their answers 5.47 on average for financing decisions and 5.24 times on average for investment decisions. In other words, participants changed their answers 4% times more in making financing than investment decisions. Financing decisions could require a higher mental effort than investment decisions because people are less familiar with financing decisions. A higher cognitive load leads to less restraint on temptation and behavioral anomalies. Thus, unlike investment decisions, individuals are not influenced by treatments.

Also, individuals could use a naive rule when they make financing decisions because they are not used to it. When people face an unfamiliar task, they tend to apply a naive rule (Harbaugh et al., 2009). Table 7 shows that participants spent 4% more time to make financing decisions compared to investment decisions. On average, subjects took 122 seconds to make investment decisions but took 128 seconds to make financing decisions. This can lead to making financing decisions more difficult to be influenced by treatments. Another reason can be a division of cognitive processes. Kahneman (2011) argues that individuals use two systems of thought. System 1 produces reactions that require no effort, and System 2 requires more deliberative thinking. However, it is not observable which System subjects use. Using the time it took for first clicks on all questions, we can see what decisions need more reaction time; it took subjects

34 seconds and 45 seconds to make their first investment and financing decisions, respectively. It could be possible that financing decisions require more deliberative thinking by using System 2. Thus, treatments could affect the financing decisions less.

Findings from this paper raise some questions about financing decisions. Further studies can explain why individuals with different stimuli behave the same in financing decisions. However, it is evident that contrast effects can lead to mistakes in investment decisions. These results show that contrast effects help solve equilibrium puzzles in financial economics.

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Table 1 The Six Prospects

Prospect Number	Lottery	Expected Value	FFP Risk Attitude
1	1/10 of +\$20, 9/10 of +\$0	\$2	Seeking
2	4/10 of +\$20, 6/10 of +\$0	\$8	Neutral
3	8/10 of +\$20, 2/10 of +\$0	\$16	Averse
4	1/10 of -\$20, 9/10 of +\$0	-\$2	Averse
5	4/10 of -\$20, 6/10 of +\$0	-\$8	Neutral
6	8/10 of -\$20, 2/10 of +\$0	-\$16	Seeking

Table 2 Payoff Matrix with Treatments

Type	Stock	Bond	FFP Risk Attitude	Predicted Risk Attitude (Economic Boom)	Predicted Risk Attitude (Economic Depression)
Investing Decisions	1/10 of +\$0.5, 9/10 of +\$0	\$0.05	Seeking	More Seeking	Less Seeking
	4/10 of +\$0.5, 6/10 of +\$0	\$0.2	Neutral	Neutral	Neutral
	8/10 of +\$0.5, 2/10 of +\$0	\$0.4	Averse	Less Averse	More Averse
Financing Decisions	1/10 of -\$0.5, 9/10 of -\$0	-\$0.05	Averse	Less Averse	More Averse
	4/10 of -\$0.5, 6/10 of -\$0	-\$0.2	Neutral	Neutral	Neutral
	8/10 of -\$0.5, 2/10 of -\$0	-\$0.4	Seeking	More Seeking	Less Seeking

Table 3 Group Matrix

	No Pictures	Economic Boom Pictures	Economic Depression Pictures
No Articles	Group A	Group B	Group C
Economic Boom Articles	Group D	Group E	x
Economic Depression Articles	Group F	x	Group G

Table 4 Payoff Matrix

Type	Stock	Bond	FFP Risk Attitude
Investing Decisions	1/10 of +\$0.5, 9/10 of +\$0	\$0.05	Seeking
	4/10 of +\$0.5, 6/10 of +\$0	\$0.2	Neutral
	8/10 of +\$0.5, 2/10 of +\$0	\$0.4	Averse
Financing Decisions	1/10 of -\$0.5, 9/10 of -\$0	-\$0.05	Averse
	4/10 of -\$0.5, 6/10 of -\$0	-\$0.2	Neutral
	8/10 of -\$0.5, 2/10 of -\$0	-\$0.4	Seeking

Table 5 Demographic Information

Mean (Std.)	Group A	Group B	Group C	Group D	Group E	Group F	Group G
Observation	64	65	63	60	68	61	66
Age	40.17 (10.70)	39.69 (10.59)	39.71 (11.85)	39.88 (10.70)	39.87 (11.15)	39.93 (10.20)	40.24 (10.78)
Education	1.84 (0.74)	1.82 (0.79)	1.79 (0.81)	1.85 (0.71)	1.69 (0.63)	1.95 (0.74)	1.83 (0.65)
Gender	1.59 (0.46)	1.38 (0.49)	1.63 (0.52)	1.48 (0.50)	1.60 (0.49)	1.52 (0.50)	1.56 (0.50)

Notes: Gender is a variable, where 1 means female and 2 means male. Education is a variable between 1 and 4, where 1, 2, 3, and 4 represent High School, Bachelor's Degree, Master's Degree, and Ph.D. Degree, respectively.

Table 6 Proportion of Stock by Treatments

Comparison Between Groups Exposed to Economic Boom and Depression Pictures

Type	Stock	Bond	Proportion of Stock	
			Group B (Boom)	Group C (Depression)
Investing	1/10 of +\$0.5, 9/10 of +\$0	\$0.05	0.22	0.14
Decisions	4/10 of +\$0.5, 6/10 of +\$0	\$0.2	0.22	0.22
	8/10 of +\$0.5, 2/10 of +\$0	\$0.4	0.42	0.33
Financing	1/10 of -\$0.5, 9/10 of -\$0	-\$0.05	0.29	0.44
Decisions	4/10 of -\$0.5, 6/10 of -\$0	-\$0.2	0.29	0.40
	8/10 of -\$0.5, 2/10 of -\$0	-\$0.4	0.42	0.44

Comparison Between Groups Exposed to Economic Boom and Depression Articles

Type	Stock	Bond	Proportion of Stock	
			Group D (Boom)	Group F (Depression)
Investing	1/10 of +\$0.5, 9/10 of +\$0	\$0.05	0.20	0.28
Decisions	4/10 of +\$0.5, 6/10 of +\$0	\$0.2	0.25	0.23
	8/10 of +\$0.5, 2/10 of +\$0	\$0.4	0.40	0.41
Financing	1/10 of -\$0.5, 9/10 of -\$0	-\$0.05	0.28	0.30
Decisions	4/10 of -\$0.5, 6/10 of -\$0	-\$0.2	0.35	0.26
	8/10 of -\$0.5, 2/10 of -\$0	-\$0.4	0.43	0.52

Comparison Between Groups Exposed to Economic Boom and Depression Pictures and Articles

Type	Stock	Bond	Proportion of Stock	
			Group E (Boom)	Group G (Depression)
Investing	1/10 of +\$0.5, 9/10 of +\$0	\$0.05	0.35***	0.08***
Decisions	4/10 of +\$0.5, 6/10 of +\$0	\$0.2	0.29**	0.14**
	8/10 of +\$0.5, 2/10 of +\$0	\$0.4	0.32	0.45
Financing	1/10 of -\$0.5, 9/10 of -\$0	-\$0.05	0.37	0.30
Decisions	4/10 of -\$0.5, 6/10 of -\$0	-\$0.2	0.37	0.30
	8/10 of -\$0.5, 2/10 of -\$0	-\$0.4	0.41	0.50

Notes: *** and ** represent p-values smaller than 0.01 and 0.05, respectively. P-values of the test of proportion for having the same proportions across two groups are reported.

Table 7 Time and Click Counts

Comparison Between Investment and Financing Decisions

Type	Investment Decisions	Financing Decisions	Paired T-Test
	Mean	Mean	Two-sided p-value
First Click Time	34.41	44.55	0.00
Page Submit Time	122.32	127.61	0.02
Click Counts	5.24	5.47	0.03

Notes: Variables are winsorized at 5% level before taking a mean to account for outliers. First click time represents the total number of seconds that individuals initially took to click for all questions. Page submit time represents the total number of seconds that individuals finished all questions. Click counts represents the number of clicks that subjects made for all questions.

Figure 1 Weighting Function

